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EXAMINER

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ART UNIT

PAPER NUMBER

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/055,201

Applicant(s)
Br wn, W., Herchen, H., Welch, M.D.

Examiner
Rudy Zervigon

Group Art Unit
1763



☒ Responsive to communication(s) filed on Dec 8, 2000

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) 1-11, 14, 15, 24, and 26-78 is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☒ Claim(s) 10, 11, 14, 15, 24, 26-30, 33-36, 40-73, and 75-78 is/are allowed.

☒ Claim(s) 1-6, 8, 9, 31, and 32 is/are rejected.

☒ Claim(s) 7, 37-39, and 74 is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s) _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

1, 2, 6, 9, 31
3, 8, 32
4, 5

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

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DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1,2,6,9,31 are rejected under 35 U.S.C. 102(b) as being anticipated by Randall S. Mundt (U.S.Pat. 5,137,701). Randall S. Mundt describes an apparatus and method for eliminating unwanted materials from a gas flow line (title). The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Specifically, Randall S. Mundt describes a process chamber (12; column 2, lines 64-68) anticipated for processing a substrate (column 2, lines 64-68; column 8, lines 40-45) in a process gas and reducing emissions of hazardous gas to the environment (abstract). Randall S. Mundt additionally describes the process chamber (12; column 2, lines 64-68; column 8, lines 40-45) where there is anticipation for processing a substrate on a substrate support and a gas distributor capable of introducing process gas into the process chamber (column 2, lines 64-68; column 8, lines 40-45). Additionally, Randall S. Mundt anticipates a gas activator (column 2, lines 64-68; column 8, lines 40-45). Randall S. Mundt also teaches a reagent gas mixer capable of mixing a reagent gas with the effluent (column 3, lines 3-18).

Randall S. Mundt also describes an exhaust tube (18) through which the effluent may be flowed. The exhaust tube having an internal flow surface (82) substantially free of projections or recesses that alter the flow direction of the effluent through the exhaust tube.

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Randall S. Mundt also describes a distributor plate (74 Fig.3) having holes (column 8, lines 1-11) adapted to direct effluent preferably along the internal flow surface of the exhaust tube.

Randall S. Mundt also describes a microwave energy applicator (column 3, line 49 - column 4, line 11) to couple microwaves to the effluent flow through the exhaust tube to reduce the hazardous gas content of the effluent (column 2, lines 64-68; column 8, lines 40-45).

Randall S. Mundt anticipates an exhaust tube with a length sufficiently long to reduce the hazardous gas content of a continuous stream of effluent flowing through the exhaust tube without recirculating the effluent (column 6, lines 23-27)

1b →
• int. flow // with direction of flow
• ex. tube wh. ahead of propagation...

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Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 3,8,32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) as applied to claims 1,2, and 6 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt does not make specific reference to a residence time in the processing reactor of the gas to be treated. Additionally, Randall S. Mundt does not make specific reference to an RF energy applicator coupling RF energy to the exhaust tube.

Chiu discloses an exhaust system apparatus, plasma extraction reactor (lines 66-68, column 2), for treating effluent gas streams from plasma processes (Figures 1-6). Chiu specifically applies the plasma extraction reactor to remove vapor phase environmental contaminants from effluent gas streams generated by semiconductor processing equipment generating plasma states (line 61-68, column 2). Chiu also discloses the location of his plasma extraction reactor relative to a CVD process (lines 1-18, column 6).

Chiu's exhaust system apparatus also make use of an RF energy applicator coupling RF energy to the exhaust tube (column 6, lines 59-63).

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According to the following demonstration, the requirement that the flow path be of sufficient length to provide an effluent gas residence time of at least 0.01s in the exhaust plasma extraction reactor stipulated in claim 3 is implicitly satisfied under the teachings of Chiu¹.

A person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and, thus, as was demonstrated in the Examiner's calculations sheet (provided as an attachment to the first Office Action) provide residence time of the effluent flowing through the exhaust tube that is at least about 0.01 seconds.

Motivation for altering the geometry of the Randall S. Mundt effluent gas reactor according to the Kin-Chung Chiu design parameters is for allowing sufficient time for the contaminants to react (column 3, lines 24-45).

A person of ordinary skill in the art at the time the invention was made would have found it obvious to add the Chiu RF energy applicator coupling RF energy to the exhaust tube (column 6, lines 59-63) to the Randall S. Mundt effluent treatment device as motivated by Chiu's removal efficiencies (column 9, lines 14-28).

5. Claims 4,5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S.Pat. 5,137,701) as applied to claims 1,2, above, and further in view of Kin-Chung Chiu (U.S.

¹Refer to the Examiner's calculation sheet.

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Pat. 4,735,633). Randall S. Mundt does not make specific reference to the flow regime (turbulent or laminar) in the processing reactor of the gas to be treated.

Variations on contact area of the reacting effluent are considered and integrated into the design by altering the geometry of the flow path (lines 24-45, column 3). Among the geometric design considerations of the internal flow chamber put forth by Chiu include a flow path length to ensure sufficient removal of the effluent gas (lines 24-30, column 3), a high ratio of electrode area to reactor volume (lines 11-23, column 3), electrode surface area to flow rate of gas to be optimally set for vapor removal capacity (lines 30-37, column 3). Although Chiu does not explicitly make reference to the flow regime, either turbulent or laminar, when passing the effluent gas through the plasma extraction reactor. Chiu also does not explicitly make reference to the surface characteristics of the flow path. However, because Chiu discusses variations of the internal flow chamber geometry as well as flow characteristics of the effluent gas in the range of values outlined in lines 8-45 column 3 Chiu is implicitly favoring laminar, unhindered, flow of the effluent gas through his plasma extraction reactor. Any author describing internal fluid flow, such as Chiu, would consider that the direction of fluid flow (velocity vector), substantially distant from the boundary layer, and the tangent to the surface of the encasement are an implicitly parallel. Chiu does point out that in order to reduce the size of his plasma extraction reactor, the processing pipe can be convoluted (lines 57-62, column 4) as apposed to the larger processing space required for a linear plasma processing apparatus. Projections or recesses, beyond boundary layer variability, are also implicitly taught by

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Chiu under the observation that the geometric design considerations of the internal flow chamber and flow rates for sufficient removal put forth by Chiu (lines 11-37, column 3) would have to be reinvestigated/recalculated if projections or recesses were present in Chiu's plasma extraction reactor. Figures 1-6 also support flow surfaces absent of projections and or recesses.

A person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and thus provide for laminar flow in the processing tube. Motivation is provided by Randall S. Mundt's discussion of flow rate ratio to electrode area (column 3, lines 30-45).

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Allowable Subject Matter

6. Claims 7, 37-39, 74 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. Claims 10-12, 14, 15, 24-30, 33-36, 40-73, 75-78 are allowed.

8. The following is a statement of reasons for the indication of allowable subject matter: Independent claims 10, 11, 26, and 28 are allowed because none of the cited references provide the claimed conditions of operation of the microwave energy applicator coupling microwaves to the effluent and thereby energizing the exhaust gases in the exhaust tube as provided by the computer controller.

Independent claim 24 is allowed because the amended claim distinguishes from the closest related art, by Randall S. Mundt (U.S.Pat. 5,137,701), in the following point:

- i. The exhaust tube (22, 24, 18, 30; Figure 1) through which the effluent may be flowed is *not* described as being fabricated from monocrystalline sapphire

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Response to Arguments

9. Applicant's arguments filed December 8, 2000[✓] have been fully considered but they are not persuasive.

10. With regards to Randall S. Mundt not teaching: "...claim 1, as amended, is to a process chamber for processing a substrate in a process gas and reducing the emissions of hazardous gas to the environment having...." it is provided in this and prior actions that Randall S. Mundt teach:

The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Specifically, Randall S. Mundt describes a process chamber (12; column 2, lines 64-68) anticipated for processing a substrate (column 2, lines 64-68; column 8, lines 40-45) in a process gas and reducing emissions of hazardous gas to the environment (abstract).

In addition, Randall S. Mundt teaches an exhaust tube (18) through which the effluent may be flowed and having an internal flow surface (82) substantially free of projections or recesses that alter the flow direction of the effluent through the exhaust tube. The "projections" as viewed by the applicant in the amendment of December 8, 2000 are channels for flow. "Projections" as embodied by the present application are surficial ("...internal flow surface...", "...surface roughness...") discontinuities that "provide a laminar flow of effluent..." (Page 11, lines 8-30). This same position applies to the same argument given for Chiu.

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Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.


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